Effects of Proprioceptive Neuromuscular Facilitation (PNF) Stretching to Reduce Occupational Overuse Syndrome (OOS) on the Mechanics of Ahass Motorbike Reparation Workshop in Tembalang, Semarang City

by Yuliani Setyaningsih

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EFFECTS OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION (PNF) STRETCHING TO REDUCE OCCUPATIONAL OVERUSE SYNDROME (OOS) ON THE MECHANICS OF AHASS MOTORBIKE REPARATION WORKSHOP IN TEMBALANG, SEMARANG CITY

Muhammad Fadillah Zulhayudin, Yuliani Setyaningsih and Suroto
Diponegoro University, Semarang City, Central Java Province, Indonesia

ABSTRACT

Occupational Overuse Syndrome is trauma experienced by the musculo-skeletal system as a result of accumulation of symptoms in the upper body of the body caused by overwork effects on the musculo-skeletal system. The percentage of musculo-skeletal system disorders in workshop mechanics in some countries reaches 76 - 92%. The initial survey results using the Nordic Body Map Questioner informed that the AHASS motorbike mechanic in Tembalang experienced pain in the upper body. Therefore, it is necessary to intervene to reduce the pain. From several existing stretching techniques, PNF stretching was chosen as an intervention to be given. The purpose of this study was to examine whether PNF stretching which could reduce OOS or not in AHASS mechanical workshop in Tembalang, Semarang. The type of research in this study is quantitative with a quasi-experimental design. Based on the cluster sampling technique with the survey survey method, 30 samples were found and divided into 3 groups, namely the intervention group 6 times a week, the intervention group 3 times a week and the control group. Each group contains 10 respondents. Measurement of pain scale using the Visual Analogue Scale. The results showed that there was a significant decrease in pain scale after intervention with PNF stretching 6 times a week or 3 times a week. The conclusion of this research is PNF stretching effect reduces OOS pain in AHASS motorbike mechanic workshop in Tembalang, Semarang.

KEYWORDS: Occupational Overuse Syndrome, Mechanics, PNF Stretching

INTRODUCTION

Occupational Overuse Syndrome (OOS) is one of several terms used to express the musculo-skeletal disorders. The term OOS is commonly used in Australia and in the United Kingdom. In America it is known as "Cumulative Trauma Disorders" (CTD), whereas in Japan and Scandinavian countries it is known as "Occupational Cervicobrachial Disorders" (OCD).[1] Occupational Overuse Syndrome (OOS) is a trauma experienced by the musculo-skeletal system as a result of accumulation of cervical symptoms in the upper limbs of the body including the neck, upper back, shoulders, arms and hands caused by overwork effects on the musculo-skeletal system namely muscles, nerves, joints and ligaments.[2] The World Health Organization (WHO) states that the musculo-skeletal disorders are Occupational Diseases in the first five continents is 48%.[3] The Ministry of Health of the Republic of Indonesia reports that the musculo-skeletal disorders in workers in Indonesia reaches 40.5%.[4] In

Semarang City, suspected cases of occupational diseases reported by the Health Office The city of Semarang in 2018 recorded as many as 28,416 cases.[5]

Working as a mechanic in a motorbike repair shop has the potential to experience the musculo-skeletal disorders. Some research results show that musculo-skeletal disorders in workshop mechanics have a relatively high percentage. In Malaysia, musculo-skeletal disorders in the mechanics of motorbike workshop reached 87.4% to 91.7%, while in India it reached 85% and Bangladesh 77% and in Norway it reached 76%. [6-8]

The results of observations using google map, showed that there were at least 6 AHASS (Astra Honda Authorized Service Station) motorcycle workshops in Tembalang District. However, not all of them are used as research sites, but only the motorcycle workshop that is around the student distribution area. With cluster technique and search survey method, it is known that Tembalang Village, Kramas and Bulusan are the distribution area of students where there are 3 AHASS motorcycle workshops there. These three villages are home to students from several large campuses such as Diponegoro University, Semarang State Polytechnic, Semarang Health Polytechnic and Pandanaran University, considering that they are from various regions in Indonesia.

The Semarang City Department of Transportation, Communication and Information noted that the number of motorized vehicle ownership in Tembalang District was 10,740 motorcycles.[9] If the number of motorbikes that have been recorded combined with the number of motorbikes owned by students brought from outside Tembalang District, of course the number of motorcycles in the District will increase, thus affecting the needs of motorbike users to maintain or repair their bikes. That way, the workshop as a provider of motorcycle maintenance and repair services will be crowded. This statement is supported by the results of direct observation that researchers found one AHASS motorcycle workshop located on Jalan Sirojudin Tembalang, which in September 2017 was awarded by PT. Astra Internasional Tbk. as the AHASS record breaking unit entry 1,567 in the first month of operation.

But on the other hand, based on an initial survey using the Nordic Body Map Questioner, researchers found information that AHASS mechanics felt pain in the upper body when working. For this reason, researchers consider that intervention is needed to reduce the pain. On the basis of easy, inexpensive, applicative considerations and as support for the Healthy Living Community Movement or Gerakan Masyarakat Hidup Sehat (GERMAS) program, the researchers chose Proprioceptive Neuromuscular Facilitation (PNF) stretching as an intervention effort.

The selection of PNF stretching as an intervention effort is based on several research results that show the superiority of PNF stretching compared to other stretching techniques. A study of the effects of the four stretching techniques to develop flexibility of the spinal joints, resulting in the development of flexibility as far as 2.40 cm using dynamic stretching methods, static stretching 2.70

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Vol. 2, No. 06; 2019

cm, passive stretching 4.60 cm and PNF stretching 5.85 cm.[10] PNF stretching can increase flexibility by 6.8% compared to static stretching by 5.7% .[11]

Based on the description above, the researchers would like to conduct research on the Effects of PNF Stretching to Reduce Symptoms of Occupational Overuse Syndrome (OOS) on the AHASS Motorcycle Workshop Mechanics in Tembalang - Semarang.

MATERIALS AND METHODS

Research design

This type of research is quantitative with a quasi-experimental design (non equivalent control group). In this design, researchers used a control group and an experimental group. Both groups were pre-tested and post-tested, but only the experimental group was treated.[12,13] Scheme of the research model:

1. The experimental group →O_1_____X_1 X_2_____O_2
2. Control group O_1_____O_2

Notes:

- In total there are 3 groups consisting of 2 experimental groups and 1 control group
- O_1: Measurement of pain scale before treatment
- X_1: Group 1 who received PNF stretching treatment 6 times a week
- X_2: Group 2 who received PNF stretching treatment 3 times a week
- O_2: Measurement of pain pain scale after administration of treatment

Population and Sample

1. Population

Based on observations using google maps, there are 6 AHASS motorcycle workshops scattered in Tembalang District, where each motorcycle workshop has 10 mechanics, so the total number of mechanics is 60. The population is the whole object of research.[13] Therefore, the population in this study there are 60 AHASS mechanics in Tembalang District, Semarang.

2. Samples

The sample is representative of the population. The sampling technique in this study uses a cluster sampling technique which is to take a sample based on a predetermined population area. The survey method of search by using a motorcycle was conducted to determine the distribution area of students. The results can be seen that the 3 villages in Tembalang district are the student distribution areas, namely Tembalang, Kramas and Bulusan. There are 3 AHASS motorcycle workshops around the

ISSN 2581-5148

Vol. 2, No. 06; 2019

three villages where each motorcycle workshop has 10 mechanics, so there are 30 mechanics. Then the samples in this study were 30 respondents.

Research Instruments

1. Informed Consent to request respondent's approval
2. Questionnaire to ask for variables of age, years of service and sports
3. Stopwatch to calculate the pulse to determine the respondent's workload.

$$\text{Pulse per minute} = \frac{10\ pulse}{time\ calculates\ using\ stopwatch}\ x\ 60$$

4. Visual Analogues Scales (VAS) to determine the scale of OOS pain
5. Cameras for documenting research and stationery

Data Analysis

Univariate analysis was used to determine the frequency distribution, bivariate analysis using the Shapiro-Wilk test, Kruskal Wallis, Wilcoxon, Paired T-test. Mann Whitney Test, One way ANOVA, and Post hoc.[15]

Research Duration

This research was conducted in July - September 2019

RESULTS

Risk Factors of Respondents

The most age group in this study was ≥ 30 years (56.7%) and the longest working period in this study was > 5 years (56.7%). While the most workload in this study was light workload (86.7%). Furthermore, 66.7% of respondents in this study did not exercise.

Difference Between Neck Pain Before and After Intervention with PNF Stretching Technique

Table 1. Descriptive, Normality and Pain Difference Before and After Treatment

Neck Pain	Group	Mean ± SD	Median (min - max)	p*
Pre	Treatment 1	4.30 ± 1.25	4 (2 - 6)	0.436*
	Treatment 2	4.70 ± 1.16	4.5 (3 - 7)	0.328 *
	Control	4.20 ± 1.14	4 (2 - 6)	0.479 *
Post	Treatment 1	1.50 ± 0.97	2 (0 - 3)	0.095 *
	Treatment 2	3.30 ± 1.16	3.5 (1 - 5)	0.328 *

ISSN 2581-5148

Vol. 2, No. 06; 2019

	Control	4.60 ± 1.08	4 (3-6)	0.030
Difference	Treatment 1	-2.80 ± 0.92	-2.5 (-4 - (-2))	0.004
	Treatment 2	- 1.40 ± 0.52	-1 (-2 - (-1))	0,000
	Control	0.40 ± 0.52	0 (0-1)	0,000

Note: * Normal (p> 0.05); ¿Shapiro-wilk Source: Primary Data

Table 1 show that there was a decrease in the average value in the treatment group 1 and treatment group 2. The average value of the treatment group 1 before the intervention was 4.30 and after the intervention decreased to 1.50 with a difference of 2.80. While the average value of treatment group 2 before the intervention was 4.70 and after the intervention decreased to 3.30 with a difference of 1.40. However, in the control group an increase in the average value which was originally at 4.20 increased to 4.60 with a difference of 0.40. The results of the normality test using the Shapiro- Wilk test before treatment in groups 1, 2 and the control showed distributed data normal because the p value > 0.05. Data normality after treatment in group 1 and group 2 was normally distributed because the p value > 0.05 while in the control group was not normally distributed because the p value < 0.05. The differences in groups 1, 2 and control were not normally distributed because the p value < 0.05.

Table 2. Differences in Neck Pain (Pre, Post and the Difference) Based on Treatment

Neck Pain	Pre	Post	P value	Difference
Treatment 1	4.30 ± 1.25	1.50 ± 0.97	<0.001¶ *	-2.80 ± 0.92
Treatment 2	4.70 ± 1.16	3.30 ± 1.16	<0.001¶ *	-1.40 ± 0.52
Control	4.20 ± 1.14	4.60 ± 1.08	0.046 † *	0.40 ± 0.52
p	0,612§	<0,001 ‡		* <0,001 ‡ *

Note: * Significant (p <0.05); § One Way ANOVA; Rus Kruskalwallis; ¶ Paired; †Wilcoxon Source: Primary Data

Table 2 shows that based on the results of different tests using paired tests, the difference in neck pain in treatment group 1 before and after treatment was significant because the p value = <0.011 < α = 0.05 with a difference of 2.80. The difference in neck pain in treatment group 2 before and after treatment was also significant because the p value = <0.011 < α = 0.05 with a difference of 1.40. While based on the Wilcoxon test, the difference in neck pain in the control group before and after treatment was significant because p value = 0.046 > α = 0.05 with a difference of 0.40. Based on the results of different tests using one oway anova, the difference in neck pain before treatment between groups 1, 2 and control was not significant because the p value = 0.612 > α = 0.05. After treatment, the difference in neck pain between groups 1, 2 and control became significant because the results of different tests using the Kruskal Wallis test showed a p value = <0.001 <α = 0.05 and the difference in neck pain difference between groups 1, 2 and control was significant because the p value = <0.001 <α = 0.05.

ISSN 2581-5148

Vol. 2, No. 06; 2019

Differences in Upper Back Pain Before and After Intervention with the PNF Stretching Technique

Table 3. Descriptive, Normality and Difference in Upper Back Pain Before and After Treatment

Neck Pain	Group	Mean ± SD	Median (min - max)	p¿
Pre	Treatment 1	5,50 ± 1,35	5,5 (3 – 7)	0,276*
	Treatment 2	5,10 ± 1,79	5,5 (3 – 8)	0,246*
	Control	5,40 ± 1,27	5,5 (3 – 7)	0,445*
Post	Treatment 1	2,10 ± 0,88	2 (1 – 3)	0,017
	Treatment 2	3,60 ± 1,58	4 (1 – 6)	0,709*
	Control	5,70 ± 1,16	6 (4 – 7)	0,124*
Difference	Treatment 1	-3,40 ± 0,70	-3,5 (-4 – (-2))	0,008
	Treatment 2	-1,50 ± 0,53	-1,5 (-2 – (-1))	0,000
	Control	0,30 ± 0,48	0 (0 – 1)	0,000

Note: * Normal (p> 0.05); ¿Shapiro-wilk Source: Primary Data

Table 3 shows that there was a decrease in the average value in treatment group 1 and treatment group 2. The average mean of treatment group 1 before intervention was 5.50 and after intervention decreased to 2.10 with a difference of 3.40. While the average mean of treatment group 2 before intervention was 5.10 and after intervention it decreased to 3.60 with a difference of 1.50. However, in the control group an increase in the initial average mean of 5.40 increased to 5.70 with a difference of 0.30.

Table 4. Differences in Upper Back Pain (Pre, Post and the Difference) Based on Treatment

Neck Pain	Pre	Post	P value	Difference
Treatment 1	5,50 ± 1,35	2,10 ± 0,88	0,004†*	-3,40 ± 0,70
Treatment 2	5,10 ± 1,79	3,60 ± 1,58	<0,001¶*	-1,50 ± 0,53
Control	5,40 ± 1,27	5,70 ± 1,16	0,081¶	0,30 ± 0,48
p	0,823§	<0,001‡*		<0,001‡*

Note: * Significant (p <0.05); § One Way ANOVA; Rus Kruskalwallis; ¶ Paired; †Wilcoxon Source: Primary Data

Table 4 shows that based on different test results using Wilcoxon test, the difference in upper back pain in treatment groups 1 before and after treatment was significant because the p value = 0.004 < α = 0.05 with a difference of 3.40. The difference in upper back pain based on paired test in treatment group 2 before and after treatment was also significant because the p value = <0.001 <α = 0.05 with a difference of 1.50. While based on paired tests, the difference in upper back pain in the control group before and after treatment was not significant because p value = 0.081> α = 0.05 with a difference of 0.30. Based on the results of different tests using one oway anova, the difference in

ISSN 2581-5148

Vol. 2, No. 06; 2019

upper back pain before treatment between groups 1, 2 and control was not significant because the p value = 0.823> α = 0.05. After treatment, the difference in upper back pain between groups 1, 2 and control became significant because the results of different tests using the kruskal wallis test showed a p value = <0.001 <α = 0.05 and the difference in upper back pain between groups 1, 2 and control was significant because the p value = <0.001 <α = 0.05.

Difference Between Shoulder Pain Before and After Intervention with PNF Stretching Technique

Table 5. Descriptive, Normality and Difference in Shoulder Pain Before and After Treatment

Neck Pain	Group	Mean ± SD	Median (min - max)	p¿
Pre	Treatment 1	5,60 ± 1,51	6 (2 – 7)	0,022
	Treatment 2	4,30 ± 1,77	3,5 (2 – 7)	0,070*
	Control	5,60 ± 1,51	6 (2 – 7)	0,022
Post	Treatment 1	2,20 ± 1,03	2 (0 – 4)	0,043
	Treatment 2	2,50 ± 1,72	2 (0 – 5)	0,398*
	Control	5,80 ± 1,55	6 (2 – 7)	0,006
Difference	Treatment 1	-3,40 ± 0,84	-3 (-5 – (-2))	0,172*
	Treatment 2	-1,80 ± 0,79	-2 (-3 – (-1))	0,025
	Control	0,20 ± 0,63	0 (0 – 2)	0,000

Note: * Normal (p> 0.05); ¿Shapiro-wilk Source: Primary Data

Note: * Normal (p> 0.05); ¿Shapiro-wilk Source: PTable 5 shows that there was a decrease in the mean value in treatment group 1 and treatment group 2. The average mean of treatment group 1 before intervention was 5.60 and after intervention it decreased to 2.20 with a difference of 3.40. While the average mean of treatment group 2 before intervention was 4.30 and after intervention it declined to 2.50 with a difference of 1.80. However, in the control group an increase in the initial average mean of 5.60 increased to 5.80 with a difference of 0.20. The results of the normality test using the Shapiro-Wilk test before treatment in group 1 and the control group showed data were not normally distributed because the p value < 0.05 while in group 2 showed data were normally distributed because the p value > 0.05. Data normality after treatment in group 1 and control were not normally distributed because the p value <0.05 while in group 2 it was normally distributed because the p value > 0.05. The differences in group 1 were normally distributed because the p value > 0.05 while the difference in group 2 and the control group were not normally distributed because the p value <0.05.

ISSN 2581-5148

Vol. 2, No. 06; 2019

Table 6. Differences in Shoulder Pain (Pre, Post and the Difference) Based on Treatment primary Data

Neck Pain	Pre	Post	P value	Difference
Treatment 1	5,60 ± 1,51	2,20 ± 1,03	0,004†*	-3,40 ± 0,84
Treatment 2	4,30 ± 1,77	2,50 ± 1,72	<0,001¶*	-1,80 ± 0,79
Control	5,60 ± 1,51	5,80 ± 1,55	0,317†	0,20 ± 0,63
p	0,212‡	0,001‡*		<0,001‡*

Note: * Significant (p <0.05); ‡One Way ANOVA; Rus Kruskalwallis; ¶ Paired; †Wilcoxon Source: Primary Data

Table 6 shows that based on the results of different tests using the Wilcoxon test, the difference in shoulder pain in treatment groups 1 before and after treatment was significant because the p value = 0.004 < α = 0.05 with a difference of 3.40. The difference in shoulder pain based on paired test in treatment group 2 before and after treatment was also significant because the p value = <0.001 < α = 0.05 with a difference of 1.80. Whereas based on Wilcoxon test, the difference in shoulder pain in the control group before and after treatment was not significant because p value = 0.317> α = 0.05 with a difference of 0.20. Based on the results of different tests using the kruskal wallis test, the difference in shoulder pain before treatment between groups 1, 2 and control was not significant because the p value = 0.212> α = 0.05. After treatment, the difference in shoulder pain between groups 1, 2 and control became significant because the p value = 0.001 < α = 0.05 and the difference in shoulder pain difference between groups 1, 2 and control was significant because the p value = <0.001 <α = 0.05.

DISCUSSION

In this study, respondents number with the age group of ≥ 30 years are much more than age group of <30 years. The age difference between workers significantly influences complaints of musculo-skeletal disorders.16 Musculo-skeletal disorders often occur in older workers and have a large impact on their work capacity.17 The number of respondents with more than 5 years of service is much more compared to ten years ≤ 5 years . Workers with a work period of more than 5 years have a risk of 8.92 times to experience OOS pain compared to workers whose working period <5 years.3 Respondents with light workloads are more than those with moderate workloads. Physical workload was found to be an independent risk factor causing musculo-skeletal disorders.[18] The number of respondents who did not exercise are more than respondents who exercised. Intensive physical condition training for 6-10 weeks will increase the use of O2 in the muscles and increase muscular contraction energy, increase the number of capillaries that help muscle fibers improve blood flow and make bones, ligaments and tendons stronger, thereby reducing the possibility of injury.[10] That is, if you do not exercise, the risk of injury will be higher.

ISSN 2581-5148

Vol. 2, No. 06; 2019

The results showed that the pain scale significantly decreased after being given treatment in the form of PNF Stretching 6 times a week or 3 times a week for 30 days on the upper body which includes the neck, upper back and shoulders. So it can be interpreted that there is a treatment effect in the form of PNF Stretching as much as 6 times a week and 3 times a week to reduce OOS symptoms which include pain in the neck, upper back and shoulders. In line with research conducted by McGowan shows that stretching at work can reduce occupational musculo-skeletal disorders (MSDs) to employees.[19] Other studies aimed at analyzing the effect of stretching and aerobics on dysmenorrhea cases show the results that there are significant differences between before and after the treatment of dysmenorrheal reduction so the conclusion is stretching and aerobic affect to reduce dysmenorrhea.[20] Gram et. al, also concluded that physical training (stretching) at work can reduce neck and shoulder pain among office workers regardless of the level of supervision. This finding has important practical implications for future workplace interventions.[21]

The decrease in pain scale on the respondent after being given PNF stretching treatment is inseparable from how the pain can be felt by the respondent. Based on the Gate Control Theory, pain occurs due to small and large sensory stimuli that can originate from work factors, work factors as well as psychosocial and psychological factors. These stimuli are received by nociceptors in the spinal nerves which are then transmitted to the brain so that pain is felt.22,23

The Gate Control Theory also states that intense tactile stimulation applied at the same place is responsible for relieving pain at specific body locations because the stimulation affects the small nerve tissue that is distributed along the dorsal horn of the spinal cord.24

Put simply, it can be said that pain stimulus can be countered with tactile stimulus, where in this study the role as tactile stimulus is Proprioceptive Neuromuscular Facilitation (PNF) Stretching. PNF stretching works well and is effective in increasing muscle range so that muscle motion becomes more relaxed.[25,26]

The results also showed that between treatments 6 times a week against treatments 3 times a week had an equally strong effect on reducing the symptoms of Occupational Overuse Syndrome. Even so, when viewed from the magnitude of the difference in reducing OOS symptoms, it can be said that the treatment 6 times a week has a more significant effect than the treatment of 3 times a week. This is caused by the difference in frequency of treatment between the two, because there are at least 3 important parameters that have the potential to affect the success of the stretching treatment, namely frequency, intensity and duration.[27] This means that the more often the stretching is done, the more potentially affects the success of the goal. It is known that frequency, intensity and duration have been shown to increase the degree of tissue relaxation during stretching.[28] Higher intensity of strain can increase the maximum angle and duration of higher strain is an important factor for decreasing passive torque.[29] Previous studies have shown that musculoskeletal symptoms can be immediate reduced by taking breaks and by increasing the frequency of these breaks As for the control group,

based on the pre and post test results showed that there was an increase in the average pain scale on the side of the neck, back neck, upper back, shoulders, and arms, while in the hands the average pain scale pre and post looks the same. This is because it does not take any precautionary or regulatory measures. In fact, work done is work with awkward postures, standing or sitting for long periods, heavy positions of the upper limbs, excessive hand grips, and the use of vibrating devices can cause the musculo-skeletal disorders.[31]

CONCLUSION

1. Number of respondents as many as 30 people. The highest age is ≥ 30 years (56.7%), the longest work period is > 5 years (56.7%), the highest category of workload is the light workload (86.7%). There are 10 respondents (33.3%) who exercise, 60% of them exercise ≥ 3 times a week and 100% exercise with moderate intensity for 10 minutes.
2. There is a difference in pain scale on 3 parts of the body measured before and after PNF Stretching treatment 6 times a week or 3 times a week.
3. There are differences in pain scores on 3 body parts measured before and after PNF Stretching treatment 3 times a week.
4. PNF Stretching treatment 6 times a week and PNF Stretching treatment 3 times a week are both significantly influence in reducing the symptoms of Occupational Overuse Syndrome.
5. Treatment 6 times a week has a more significant effect compared to treatment 3 times a week in reducing the symptoms of Occupational Overuse Syndrome.

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